MARK F. ADAMS

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EDUCATION

Ph.D. in Civil Engineering   1998
>   University of California, Berkeley
>   Dissertation: "Multigrid Equation Solvers for Large Scale Nonlinear Finite
>   Element Simulations"
>   Co-chairs: Prof. R.L. Taylor and Prof. James Demmel

B.A. in Architecture   1983
>   University of California, Berkeley

PROFESSIONAL EXPERIENCE

Staff Scientist   2013-present
>   Scalable Solvers Group
>   Computational Research Division
>   Lawrence Berkeley National Laboratory

Adjunct Research Scientist   2013-present
>   Department of Applied Physics and Applied Mathematics
>   Columbia University

Research Scientist   2004-2013
>   Department of Applied Physics and Applied Mathematics
>   Columbia University

Technical Staff   2002-2004
>   Computer Sciences and Mathematics Center
>   Sandia National Laboratories

John von Neumann Research Fellow   2000-2002
>   Computer Sciences and Mathematics Center
>   Sandia National Laboratories

Postdoctoral Appointment   1999-2000
>   Department of Computer Science
>   University of California, Berkeley
>   with Prof. James Demmel, Department of Computer Science

Graduate Student Researcher   1996-1998
>   Department of Computer Science
>   University of California, Berkeley

Summer Intern   1998
>   Center for Applied Scientific Computing
>   Lawrence Livermore National Laboratory

PUBLICATIONS

1. *Composite matrix construction for structured grid adaptive mesh refinement,*

Computer Physics Communications (submitted), M. F. Adams, S. L. Cornford, D. F. Martin, P. McCorquodale.

2. *Landau Collision Integral Solver with Adaptive Mesh Refinement on Emerging Architectures,* SIAM J. Sci. Comp., 39, p 452-465, 2017, M. F. Adams, E. Hirvijoki, M. G. Knepley, J. Brown, T. Isaac, and R. Mills.

3. *Scalable smoothing strategies for a geometric multigrid method for the immersed boundary equations.* Advances in Computational Mathematics, In review. A. P. S. Bhalla, B. E. Griffith, M. G. Knepley, M. F. Adams, and R. D. Guy.

4. *A fast low-to-high confinement mode bifurcation dynamics in the boundary-plasma gyrokinetic code XGC1*, Physics of Plasmas, Vol. 25 Issue 5 Part 2, 2018, S. Ku, C. S. Chang, R. Hager, R. Churchill, G. Tynan, I. C., M. Greenwald, J. Hughes, S. E. Parker, E. D'Azevedo, and P. Worley.

5. *Conservative Discretization of the Landau Collision Integral*, Physics of Plasmas, 24, 3, 2017, doi: 10.1063/1.4979122, E. Hirvijoki and M. F. Adams.

6. *Verification of long wavelength electromagnetic modes with a gyrokinetic-fluid hybrid model in the XGC code,* Physics of Plasmas, 2017, R Hager, J. Lang, C.S. Chang, S. Ku, S.E. Parker, M. F. Adams

7. *Charm++ and MPI: Combining the Best of Both Worlds.* Proceedings - 2015 IEEE 29th International Parallel and Distributed Processing Symposium, IPDPS 2015. N. Jain, A. Bhatele, J.S. Yeom, M.F. Adams, F. Miniati, C. Mei, L. Kale.

8. *Segmental Refinement: A Multigrid Technique for Data Locality*, SIAM J. Sci. Comp., 38(4), p 426-440, 2016, M. F. Adams, J. Brown, M. Knepley and R. Samtaney.

9. *Trabecular Plates and Rods Determine Elastic Modulus and Yield Strength of Human Trabecular Bone*. Bone. 2015 Mar; 72:71-80, 2013, J. Wang, B. Zhou, X. S. Liu, A. J. Fields, A. Sanyal, X. Shi, M. F. Adams, T. M. Keaveny and X. E. Guo.

10. *High Resolution Simulation of Pore-Scale Reactive Transport Processes Associated with Carbon Sequestration*, Computing in Science and Engineering, No. 6, Vol. 16, p. 22-31, 2014, 2014, D. Trebotich, M. F. Adams, C. I. Steefel, S. Molins and C. Shen.

11. *Fast Trabecular Bone Strength Predictions of HR-pQCT and Individual Trabeculae Segmentation-based Plate and Rod Finite Element Model Discriminate Postmenopausal Vertebral Fractures*, J Bone Miner Res. 2013 Jul; 28(7): 1666–78, 2013, X. Liu, J. Wang, B. Zhou, E. Stein, X. Shi, M. F. Adams, E. Shane and X. Guo.

12. *Vertebral Fragility and Structural Redundancy,* J Bone Miner Res. 2012 Oct;27(10):2152-8, 2012, A. J. Fields, S. Nawathe, S. K. Eswaran, M. G. Jekir, M. F. Adams, P. Papadopoulos and T. M. Keaveny.

13. *Toward Textbook Multigrid Efficiency for Fully Implicit Resistive Magnetohydrodynamics*, JCP, Vol. 229, No. 18, p. 6208–19, 2010, M. F. Adams, R. Samtaney and A. Brandt.

14. *High-Resolution Peripheral Quantitative Computed Tomography Can Assess Microstructural and Mechanical Properties of Human Distal Tibial Bone*, Journal of Bone and Mineral Research, Vol. 25, No. 4, p. 746-756, 2010, X. Liu, X. Zhang, K. Sekhon, M. F. Adams, D. McMahon, E. Shane, J. Bilezikian and X.

Guo.

15. *Scaling to 150K Cores: Recent Algorithm and Performance Engineering Developments Enabling XGC1 to Run at Scale,* J. of Phys.: Conference Series, 180, 2009, M. F. Adams, S. Ku, P. Worley, E. D'Azevedo, J. Cummings and C. S. Chang.

16. *Whole-volume integrated gyrokinetic simulation of plasma turbulence in realistic diverted-tokamak geometry*, Chang CS, Ku S, Diamond P, Adams M, Barreto R, Chen Y, Cummings J, D'Azevedo E, Dif-Pradalier G, Ethier S et al.

17. Journal of Physics: Conference Series. 180. 01 Jan 2009

18. *Algebraic Multigrid Techniques for Strongly Indefinite Linear Systems from Direct Frequency Response Analysis in Solid Mechanics*, Computational Mechanics, Vol. 39, No. 4, p. 497-507, 2007, M. F. Adams.

19. *Toward a first-principles integrated simulation of tokamak edge plasmas*, Chang CS, Klasky S, Cummings J, Samtaney R, Shoshani A, Sugiyama L, Keyes D, Ku S, Park G, Parker S et al. Journal of Physics: Conference Series 125:01 Jan 2008

20. *Performance of Particle in Cell Methods on Highly Concurrent Computational Architectures*, J. of Phys.: Conference Series, No. 78, 2007, M. F. Adams, S. Ethier and N. Wickmann.

21. *Cortical and Trabecular Load Sharing in the Human Vertebral Body*, Journal of Bone and Mineral Research, 21(2), p. 307-314, 2006, S. K. Eswaran, A. Gupta, M. F. Adams and T. M. Keaveny.

22. *Gyrokinetic particle simulation of neoclassical transport in the pedestal/scrape-off region of a tokamak plasma*, Ku S, Chang CS, Adams M, Cummings J, Hinton F, Keyes D, Klasky S, Lee W, Lin Z, Parker S, Journal of Physics: Conference Series. 46: 87-91. 01 Oct 2006

23. *Ultrascalable Implicit Finite Element Analyses in Solid Mechanics with Over Half a Billion Degrees of Freedom*, ACM/IEEE Proceedings of SC2004: High Performance Networking and Computing, 2004, M. F. Adams, H. H. Bayraktar, T. M. Keaveny and P. Papadopoulos.

24. *Algebraic Multigrid Methods for Constrained Linear Systems with Applications to Contact Problems in Solid Mechanics*, Numerical Linear Algebra with Applications, Vol. 11, Nos. 2-3, p. 141-153, 2004, M. F. Adams.

25. *Parallel Multigrid Smoothing: Polynomial Versus Gauss-Seidel*, Journal of Computational Physics, Vol. 188, No. 2, p. 593-610, 2004, M. F. Adams, M. Brezina, J. J. Hu and R. Tuminaro.

26. *Applications of Algebraic Multigrid to Large-Scale Finite Element Analysis of Whole Bone Micro-Mechanics on the IBM SP*, ACM/IEEE Proceedings of SC2003: High Performance Networking and Computing, 2003, M. F. Adams, H. H. Bayraktar, T. M. Keaveny and P. Papadopoulos.

27. *Evaluation of Three Unstructured Multigrid Methods on 3D Finite Element Problems in Solid Mechanics*, International Journal for Numerical Methods in Engineering, Vol. 55, No. 1, p. 519-534, 2002, M. F. Adams.

28. *A Distributed Memory Unstructured Gauss-Seidel Algorithm for Multigrid Smoothers*, ACM/IEEE Proceedings of SC2001: High Performance Networking and Computing, 2001, M. F. Adams.

29. *Parallel Multigrid Solvers for 3D Unstructured Finite Element Problems in Large*

Deformation Elasticity and Plasticity, International Journal for Numerical Methods in Engineering, Vol. 48, No. 8, p. 1241-1262, 2000, M. F. Adams.

30. *Parallel multigrid solvers for 3D-unstructured large deformation elasticity and plasticity finite element problems*, Adams M, Taylor RL, Finite elements in analysis and design 36(3):197-214 01 Nov 2000

31. *Parallel Multigrid Solver Algorithms and Implementations for 3D Unstructured Finite Element Problems*, ACM/IEEE Proceedings of SC1999: High Performance Networking and Computing, 1999, M. F. Adams and J. Demmel.

TECHICAL REPORTS

1. *Simulation of long wavelength electromagnetic modes with a gyrokinetic-fluid hybrid model in the XGC code*, R. Hager, J. Lang,2, C.S. Chang, S. Ku, Y. Chen, S. E. Parker and M. Adams, To appear Physics of Plasmas.

2. *Electrostatic Gyrokinetic Simulation of Global Tokamak Boundary Plasma and the Generation of Nonlinear Intermittent Turbulence*, S. Ku, R. Churchill, C.S. Chang, R. Hager, E. Yoon, M.F. Adams, E. D'Azevedo and P. Worley, submitted to Nuclear Fusion.

3. *Composite Matrix Construction for Structured Grid Adaptive Mesh Refinement*, Submitted to Computer Physics Communications, M. F. Adams, D. F. Martin and P. W. McCorquodale.

4. *Scalable Multigrid Preconditioning Strategies for an Adaptive and Implicit Immersed Boundary Method,* submitted to Adv. Comput. Math. (arXiv:1612.02208), A. P. S. Bhalla, M. G. Knepley, M. F. Adams, R. D. Guy and B. E. Griffith.

5. *GAMG: The Native Algebraic Multigrid Framework in PETSc*, in preparation, M. F. Adams, G. N. Wells and T. Isaac.

6. *PETSc Users Manual*, Technical Report ANL-95/11−Revision 3.7, Argonne National Laboratory, 2016, S. Balay, S. Abhyankar, M. F. Adams, J. Brown, P. Brune, K. Buschelman, L. Dalcin, V. Eijkhout, W. D. Gropp, D. Kaushik, M. G. Knepley, L. C. McInnes, K. Rupp, B. F. Smith, S. Zampini, H. Zhang and H. Zhang.

7. *Exascale Computing Without Threads*. Whitepaper for the DOE High Performance Computing Operational Review (HPCOR) on Scientific Software Architecture for Portability and Performance, 2015, M. G. Knepley, J. Brown, L. C. McInnes, B. Smith, K. Rupp and M. F. Adams.

8. *Overview of the PETSc Library*. Whitepaper for the DOE High Performance Computing Operational Review (HPCOR) on Scientific Software Architecture for Portability and Performance, 2015, M. G. Knepley, J. Brown, L. C. McInnes, B. Smith, K. Rupp and M. F. Adams.

9. *Chombo Software Package for AMR Applications−Design Document*, Lawrence Berkeley National Laboratory Technical Report LBNL-6616E, 2014, M. F. Adams, P. Colella, D. T. Graves, J. N. Johnson, N. D. Keen, T. J. Ligocki, D. F. Martin, P. W. McCorquodale, D. Modiano, P. O. Schwartz, T. D. Sternberg and B. V. Straalen.

10. *HPGMG 1.0: A Benchmark for Ranking High Performance Computing Systems,*

Lawrence Berkeley National Laboratory Technical Report LBNL-6630E, 2014, M. F. Adams, J. Brown, J. Shalf, B. V. Straalen, E. Strohmaier and S. Williams.
11. *Low-Communication Techniques for Extreme-scale Multilevel Solvers*, Exascale Mathematics Workshop, DOE Office of Advanced Scientific Computing Research, 2013, M. F. Adams, J. Brown and M. Knepley.
12. *Exascale Programming Models Must Vigorously Enable Libraries*, In DOE Exascale Research Conference, 2012, M. F. Adams, J. Brown and B. F. Smith.

PROFESSIONAL SERVICE ACTIVITIES

Scientific peer review for the Swiss National Supercomputing Center, 2019

Physics of Plasmas, manuscript reviewer, 2018

Journal of Computational Physics, manuscript reviewer, 2018

Applied Mathematics and Computation, manuscript reviewer, 2018

SISC Software and High-Performance Computing Section, manuscript reviewer, 2018

Mini-symposium organizer, 18th SIAM Conference on Parallel Processing for Scientific Computing, 2018

Numerical Linear Algebra with Applications, manuscript reviewer, 2018

Physical Review Fluids, manuscript reviewer, 2017

Journal of Parallel and Distributed Computing, manuscript reviewer, 2017

Computer Physics Communications, (2) manuscript reviewer, 2017

Platform for Advanced Scientific Computing (PASC) conference, Technical Program Committee, 2017

Platform for Advanced Scientific Computing, Swiss national program project review committee, 2016

Transactions on Mathematical Software, manuscript reviewer, 2016

SISC's Copper Mountain 2016 special section, manuscript reviewer, 2016

Computational Astrophysics and Cosmology, manuscript reviewer, 2016

International Conference for High Performance Computing, Networking, Storage and Analysis, Birds-of-a-Feather session chair, *High Performance Geometric Multigrid (HPGMG): An HPC Performance Benchmark,* 2016

SISC for Special Section, manuscript reviewer, 2016

SISC Software and High-Performance Computing Section, manuscript reviewer, 2016

Platform for Advanced Scientific Computing (PASC) conference, Technical Program Committee, 2016

International Conference for High Performance Computing, Networking, Storage and Analysis, Birds-of-a-Feather session chair, *High Performance Geometric Multigrid (HPGMG): An HPC Benchmark for Modern Architectures and Metric for Machine Ranking,* 2015

SISC Software and High-Performance Computing Section, manuscript reviewer, 2015

International Conference for High Performance Computing, Networking, Storage and Analysis, manuscript reviewer, 2015

International Conference for High Performance Computing, Networking, Storage and Analysis, Birds-of-a-Feather session chair, *High Performance Geometric Multigrid (HPGMG): An HPC Benchmark for Modern Architectures and Metric for Machine Ranking,* 2014

DOE Early Career Award Review Committee, 2013

SISC Software and High-Performance Computing Section, manuscript reviewer, 2013

International Conference for High Performance Computing, Networking, Storage and Analysis, Technical Program Committee, 2012

International Parallel & Distributed Processing Symposium, Technical Papers Committee, 2012

Computer Methods in Biomechanics and Biomedical Engineering, manuscript reviewer, 2012

National Science Foundation, grant review committee, 2012

National Science Foundation, grant review committee, 2011

Swiss National Supercomputing Centre, grant application reviewer, 2011

Copper Mountain Conference on Multigrid Methods, manuscript reviewer, 2011

INVITED TALKS

A Landau Collision Integral Solver with Adaptivity on Emerging Architectures with Coupling to PIC Vlasov Methods, 18th SIAM Conference on Parallel Processing for Scientific Computing, 2018

Fast, robust, and scalable PDE-solver development for emerging architectures in PETSc, US-Japan Joint Institute for Fusion Theory, August 2017, Tokyo Japan

A Landau collision integral solver with adaptively on emerging architectures, Predictive Complex Computational Fluid Dynamics, King Abdullah University of Science and Technology, 2017

Conservative Finite Element Method for the Landau Collision Integral for Fusion Plasma Physics
King Abdullah University of Science and Technology, Thule, Saudi Arabia, 2016

HPGMG A Benchmark and Ranking Metric for High Performance Computing Systems
King Abdullah University of Science and Technology, Thule, Saudi Arabia, 2016

HPGMG: A Supercomputer Benchmark and Metric
International Supercomputing Conference, 2016

HPGMG: A Supercomputer Benchmark and Metric
Imperial College London, 2016

Experimental Investigation of the Asymptotics of Segmental Refinement Multigrid
King Abdullah University of Science and Technology, Thule, Saudi Arabia, 2016

Progress in Performance Portability of the XGC Plasma Microturbulence Codes: Heterogeneous and Manycore Node Architectures
SIAM Conference on Parallel Processing for Scientific Computing, 2016

High Performance Geometric Multigrid: A New Computer Architecture Benchmark
International High Performance Computing Forum, Tianjin City, China, 2015

Segmental Refinement: A Multigrid Technique for Data Locality
PRISM visiting fellow
Imperial College of London, London, United Kingdom, 2015

Multigrid short course
EPSRC UK-USA HPC Network visiting fellow
Cambridge University, Cambridge, United Kingdom, 2015

Multigrid for Memory (Movement) Constrained Architectures; Back to the 70's; *Multigrid Short Course*
King Abdullah University of Science and Technology, Thule, Saudi Arabia, 2014

A Proposal for a New Top500 Metric
International Supercomputing Conference, 2014

Multigrid Short Course
King Abdullah University of Science and Technology, Thule, Saudi Arabia, 2011

Nonlinear Multigrid Methods for Fully Implicit Resistive Magnetohydrodynamics Simulations; *Multigrid Short Course*
King Abdullah University of Science and Technology, Thule, Saudi Arabia, 2010

Algebraic Multigrid Solvers for Micromechanical Analyses of Human Trabecular Bone,
Best Industrial application award, Mannheim Supercomputer Conference, Mannheim, Germany, 1999